THE

Malayan Agricultural Journal.

JANUARY, 1936.

EDITORIAL.

Padi for Rice Mills.

In districts where rice production is only sufficient to supply the needs of the local cultivators, the milling quality of the padi is of secondary importance. In such cases, the padi is milled by somewhat primitive methods, and as long as the yields per acre are satisfactory and the growers satisfied with the flavour of the cooked rice, the grower is but little concerned with the amount of rice which may be broken during milling.

The situation is otherwise in the larger padi-growing areas where surplus padi production is sold to local rice mills. The miller naturally looks for padi which does not break during milling. Consequently, the work of the Department of Agriculture in such areas is towards the introduction of strains of padi which not only satisfy the growers' demands as regards yield and flavour, but the miller's requirements as regards milling quality.

Tests conducted in Krian on the milling quality of certain varieties of padi are described in a short article in this number. The results shew that the milling quality of certain padi strains is satisfactory.

The matter has, however, proceeded a stage further, propaganda work being carried out to popularize the cultivation of such varieties of padi as are desired by the millers. Visits of cultivators and headmen in the Krian District to the Government Rice Mill have been made, in order that the grower may appreciate the miller's point of view. A more practical expression has been made by the miller, who now offers a premium for consignments of certain single varieties of padi.

In Kedah, the largest and most important padi-growing State in the Peninsula, the milling qualities of the padi grown are naturally of quite as much importance as they are in Krian, as the surplus crop is very considerable and is all milled for local consumption or for export. In this State, the measures taken to encourage the cultivation of a single suitable strain in each region of uniform conditions have followed the same general lines as in Krian. In this work the rice millers have closely co-operated by such means as the presentation of prizes for suitable milling padi exhibited at the local padi show, and by the offer of a premium on the purchase of suitable strains in sufficiently large quantities.

Rice Production in Madras.

We are apt to look upon our own rice industry as of some magnitude. From the point of view of their value to the country, the 700,000 acres or so in Malaya are of importance, but in comparison with the vast scale of padi-growing in certain other countries our own areas sink into insignificance. It is important, therefore, that we should be informed of the system of cultivation obtaining in other rice-growing countries and particularly of the research work in operation in those areas.

Particular interest therefore attaches to the visit to the Madras padi-growing area of 11¼ million acres which Mr. Lowe of this Department paid in July of last year, a report on which will be found in this number.

This concise report, which is here published with the approval of the Madras Government, will be found of value particularly to those who are making a study in other countries of problems of a somewhat similar nature to those which obtain in the Madras Presidency.

Original Articles.

THE PREPARATION OF REFINED CALOPHYLLUM OIL

BY

C. D. V. GEORGI,

Acting Agricultural Chemist.

Introductory.

An investigation has recently been carried out involving the preparation of a comparatively large quantity of refined calophyllum oil for the Medical Department. Seventy-two pounds of oil were prepared.

This oil, which is being used experimentally in connexion with leprosy treatment at the Leper Settlement, Sungei Buloh, Selangor, is obtained from the fruits of *Calophyllum Inophyllum.*

Description and Distribution of Tree.

C. Inophyllum is an evergreen tree with a short trunk and spreading branches. The tree may attain a height of 60 feet.

It is widely distributed throughout the Eastern Tropics, being found in India, Burma, Ceylon, Malaya and Polynesia (1).

In Malaya the tree is found along the seashore in sandy places; for example, the coast road from Port Dickson to Malacca.

Although, as will be seen later, the oil has been used in the past as an illuminant and also as a medicine, no attempt has ever been made to cultivate the tree on a plantation scale.

In the case of the present investigation the requisite amount of fruits was obtained from the Forest Department.

Composition of Fruit.

The fruits are green in colour, globular in shape, and measure from 1 to 1¼ inches in diameter. The ripe fruits gradually turn brown in colour, the surface becoming shrivelled.

The shell of the fruit, which varies from ⅛ to ¼ inch thick, is woody on the outside, spongy in the middle, while on the inside there is a thin, brown, highly-polished lining or skin.

The kernels measure from ¾ to ⅞ inch in diameter. They are yellowish in colour when freshly opened, but turn brown on exposure to air. The discoloration is, however, confined to the surface.

The results of analysis of an average sample of ripe fruit were as follows :—

Fruit

Average weight of fruit	...	5.5 grammes
		per cent.
Proportion of shell	...	54.0
Proportion of kernel	...	46.0
		100.0

Kernel

Average weight of kernel	...	2.5 grammes
		per cent.
Moisture	...	29.2
Oil (petroleum ether extract)	...	52.7
Residue (by difference)	...	18.1
		100.0
Oil (calculated on moisture-free basis)	...	74.5

Fruit

Oil (calculated on whole fruit)	...	24.2

Characteristics of Oil.

The crude oil is dark green in colour and viscous, due to the presence of resin, which crystallizes out to some extent on long standing. The oil possesses a disagreeable odour and flavour.

The resin is acidic and can therefore be removed by appropriate treatment with sodium carbonate or sodium hydroxide, leaving a clear yellow oil. Although the refined oil has only a very slight odour, it still retains a somewhat disagreeable taste.

Some years ago an investigation (2) was carried out to determine the constants of calophyllum oil, which were found to be as follows :—

		Crude Oil.	Refined Oil.
Specific gravity (15.5°C.)	...	0.9411	0.9276
Refractive index (20°C.)	...	1.4814	1.4753
Saponification value	...	184.2	188.3
Iodine value (Wijs)	...	98.1	90.0
Acidity (oleic acid per cent.)	...	17.5	0.9

According to Dhingra and Hilditch (3) the fatty acids of the neutral glycerides of the oil, that is, of the oil free from resin, have the following

composition :—

		per cent.
Palmitic acid	... ...	15.8
Stearic acid	... ...	10.2
Oleic acid	... ...	49.4
Linoleic acid	... ...	24.0
Unsaponifiable	... ...	0.6
		100.0

Preparation of Oil.

The fruits were decorticated, the kernels cut in pieces and the material dried in a large electric oven, maintained at a temperature between 65° and 70°C., until individual pieces of kernel could be snapped between the fingers.

The dried kernels were crushed between rollers, and the resultant mass heated and pressed in a small laboratory hand-press to remove the oil.

The most satisfactory results from crushing were obtained by treating a mixture, consisting of 3 parts of kernels and 1 part of the residue remaining from a previous expression. If the kernels alone are crushed, the meal becomes very pasty and is difficult to handle.

The crude oil was bulked, allowed to settle and its acidity determined. This was found to be 19 per cent., calculated as oleic acid. Batches of the settled oil were weighed; each batch was then heated to a temperature of approximately 90°C. and treated with an amount of caustic soda (10 per cent. solution) necessary to neutralize the free fatty acids and resin acids, together with a 10 per cent. excess to ensure a rapid separation of oil and "foots".

The clear yellow oil was poured off, washed twice with boiling water to remove dissolved soap and excess of alkali, dried by treating with a small quantity of anhydrous sodium sulphate and filtered.

The refined oil had an acidity of approximately 0.5 per cent., calculated as oleic acid.

The yield of refined oil varies with the state of ripeness and quality of the fruit. The highest yield was 10 per cent. obtained with a consignment of fruits from Port Dickson.

This figure is low, compared with the calculated yield of crude oil, 24.2 per cent. It will be realized, however, that under the conditions of the experiment considerable losses of oil must be incurred, as the small laboratory press has an efficiency of only approximately 70 per cent., equivalent to a recovery of only about 17 per cent. of crude oil on the fruit. Further, the actual loss on refining an oil with an acidity of 19 per cent. will amount to at least 25 per cent., thereby reducing the maximum yield of refined oil on the fruit to about 12.5 per cent.

Application of Oil.

The crude oil was used formerly in India as an illuminant. Its principal application has been, however, for medicinal purposes, notably in skin affections. For example, in Pondicherry the oil has been used for the treatment of scabies, while, mixed with chaulmoogra oil, it has been employed successfully in the treatment of exanthematous eruptions. In Polynesia the oil has long been valued as a liniment in rheumatic affections (1).

In 1932 the Medical Superintendent, Leper Settlement, Sungei Buloh, approached the Department regarding the possibility of preparing a small quantity of the oil for experimental purposes in connexion with the alleviation of nerve pains in leper patients. Information had been received from Fiji that striking relief from nerve pain in lepra reaction had followed the intramuscular injection of small amounts either of the oil or of the ethyl esters.

The original experiments with crude oil were unsuccessful, but experiments with the refined oil—that is, the neutralized oil free from resin—confirmed the results obtained in Fiji (4).

As a result of this work the larger supply of refined oil referred to previously was prepared.

Dr. G. A. Ryrie, Medical Officer, Leper Settlement, Sungei Buloh, whose assistance in the preparation of this article is acknowledged, informed the writer that, as far as he is aware, nothing is known regarding the active principle to which the oil owes its special property.

Dr. Ryrie is of the opinion that since the oil, unlike other analgesics, is not habit-forming, there may be possibilities for its adoption in other affections and diseases associated with nerve-pains.

A supply of the refined oil has been forwarded to the Institute for Medical Research for investigation.

References.

(1) Watt, G. The Commercial Products of India, page 204.

(2) Georgi, C. D. V. Some Malayan Vegetable Oils and Fats of Minor Importance. *Malayan Agricultural Journal,* Vol. X, No. 9, September 1922, page 222.

(3) Dhingra, D. R. and Hilditch, T. P. The Fatty Acids of Some Indian Seed Oils. *Journal of the Society of Chemical Industry,* Vol. I, 1931, No. 2, page 9T.

(4) Ryrie, G. A. Some Difficulties in Leprosy. *Malayan Medical Journal,* Vol. VIII, No. 4, December 1933, page 238.

RICE RESEARCH IN MADRAS

A Report of a Visit to Coimbatore in July 1934

BY

B. A. LOWE,

Botanist (Rice Research).

Conditions of Rice Production in Madras.

The area of land under rice in Madras Presidency is approximately 11¼ million acres, nearly 14 per cent. of the total area under rice in the whole of India, including Burma, and slightly less than the area under the crop in Burma. The average production of padi in Madras is about 5¼ million tons, which gives an average of about 1,700 lbs. (equivalent to about 300 gantangs) per acre. Owing to the adoption of improved methods of cultivation advocated by the Department of Agriculture, and more particularly to the extensive use of selected seed, it is said that the yield per acre is steadily increasing. The figure given above is for the 1930-31 season, the last year for which reliable figures were available, but it is thought probable that the yield is now nearer 1,800 lbs. per acre as the use of seed selected and distributed by the Department of Agriculture is rapidly extending. Such seed has been shown to give increases of between 8 and 20 per cent. over local varieties and it is estimated that nearly 600,000 acres are now regularly planted with selected seed.

The satisfactory cultivation of the crop is primarily dependent on rainfall which is strictly seasonal and determined by the incidence of the monsoons. There are several extensive irrigation schemes which depend mainly on rivers, but they in turn are almost dry except during and immediately after the rainy seasons. Storage tanks and wells are in general use throughout the areas where water from the larger irrigation schemes is not available. Climatic conditions vary enormously in different parts of the Presidency, and, in consequence, many different systems of padi cultivation are to be found. Variations between one crop in three years and three crops in one year, between three and seven-month varieties, and between dry and deep-water padi are to be found.

The main rice-growing areas fall naturally into three groups :—the Malabar coast west of the Ghats, the dry central area, and the delta tracts on the east coast.

On the Malabar Coast, between the foothills of the Ghats and the Indian Ocean, the land is gently undulating, low hills alternating with shallow valleys in which the rivers are dry for about six months in the year. Practically the whole area is under mixed cultivation and, in general, rather resembles the low country of Malaya. The soil, which is of a lateritic nature, is thin and poor, rarely exceeding a thickness of an inch or so on hilltops or a couple of feet in the valleys. On the hill-tops and the upper slopes, dry padi is grown

once in two or three years in rotation with horse-gram, gingelly, bananas and other crops. An effort is being made by the Department of Agriculture to include pineapples (of which the Kew pine is recommended) in the rotation, as this crop has been found to give a remunerative return locally. Owing to the poverty of the soil, the growth of crops on the hills is poor. Padi is considered an exhausting crop, and, on the poorest soils, it is frequently necessary to allow one or more years of fallow after each crop. The lower slopes of the hills are terraced and irrigated from storage tanks and rivers in addition to rain which is the main source of water supply. On these terraces one 3½ to 4 month crop of wet padi is grown each year between June, when the monsoon breaks, and the end of September; for the rest of the year the land lies fallow. On the lower lands in the valleys, two short crops of padi are raised each year. The first crop is transplanted in June along with the padi on the terraces, and reaped about the end of September. Before this crop is ripe, nurseries are laid down for a second crop which is planted as soon as the land is cleared of the first crop. Sufficient water for irrigation of the second crop is available in storage tanks and wells and in the drainage from the terraces. A small amount of water is also available from the rivers which flow for several months after the cessation of the South-West Monsoon in October.

The Central district is generally dry, having a rainfall of 20 to 30 inches per annum. Conditions vary greatly, but as a rule one five-month crop of padi is raised each year. The months of January to June are very dry, but the influence of both the South-West and North-East Monsoons is felt to a limited extent between June and January. Padi is irrigated primarily from seasonal rivers supplemented by water stored in tanks and wells, but it is by no means infrequent for the rains to fail and cause the complete loss of the padi crop. Perhaps partly for this reason, the crop is usually grown in a two or three years rotation with a variety of other crops such as pulses, cotton, sugar cane, plantains and grams. In the very dry districts, which are limited in area, sorghums and millets may also be included in the rotation when an unusually dry year is anticipated.

The delta areas, which comprise the two extensive tracts of land watered by the Godavari and Caveri, with one or two minor rivers, account for the greater part of the rice land in Madras. The influence of both monsoons is felt and the rainfall is usually about 50 inches per annum. Elaborate irrigation systems distribute the water from the rivers. Soils are very deep and rich and are entirely of alluvial origin. Under these conditions heavy crops of over 3,000 lbs. of padi per acre are not infrequent. On about two-thirds of the area a single six-month crop is grown between June and December, while the remaining third carries two crops per annum, one of long and one of short duration. In the delta of the Godavari the long-term padi is grown between June and November and the short between February and May, while in the Caveri delta the reverse is the case, the short-term crop being grown between June and

September and the long between October and February. These differences in planting dates are determined by the availability of irrigation water. For the most part, padi is grown as a sole crop on the delta lands, though the Department of Agriculture is successfully advocating the growing of a green manure crop in the off-season between February and June.

Types of Rice Grown and Distribution of Selected Seed.

It is estimated that more than a thousand varieties of rice are grown in India, and of these a large number are cultivated in Madras. Considering the size of the Presidency, the great diversity of climatic conditions, and the comparative isolation of many of the districts, this diversity is not surprising. Formerly, practically all the varieties grown were very mixed and no attention was paid by the cultivator to the growing of unmixed strains. During the last twenty-five years however, the Department of Agriculture has popularized improved cultural methods and advocated the use of selected seed with very definite results. These selected strains have been shown to give increases of between 8 and 20 per cent. over the local mixed varieties; in addition, there is an advantage to the millers in dealing with standard varieties. The last-named point is perhaps of rather greater importance in Madras than in Malaya as by far the greater part of the padi grown is milled by machinery for the growers who pay in cash or in rice for the milling. It is stated that almost every village in the rice-growing districts has a good mill run by a local business man or company.

The total number of strains selected by the Department and now grown commercially is about thirty. Most of these strains have some special feature such as early maturity, better quality of grain, strength of straw or resistance to disease, which makes them of particular value in given localities or under special circumstances. The raising of hybrid strains is a comparatively new development, but several very promising hybrids have now been produced and are just reaching the stage of final trial and distribution. Many varieties of padi have been introduced experimentally from all over the world but, almost without exception, they have proved entirely unsuitable to local conditions. Now that hybridization work has been fully established however, it is possible that some of these imported varieties may contribute useful characters which can be incorporated into local strains.

A selected strain or hybrid produced at one of the rice stations is normally tested for several years against standard varieties by the strip trial method. If satisfactory it is then distributed to the other rice stations and to the Administrative Agricultural Officers for further trial. The Administrative Officers conduct a further series of strip trials on land owned by the villagers who are paid for their labour and allowed to keep the crop harvested. The Agricultural Officer examines the crop during growth for the removal of "rogues", and at harvest weighs the crop. If the final trials are satisfactory, the grower usually sells his crop of the new selection to the neighbouring

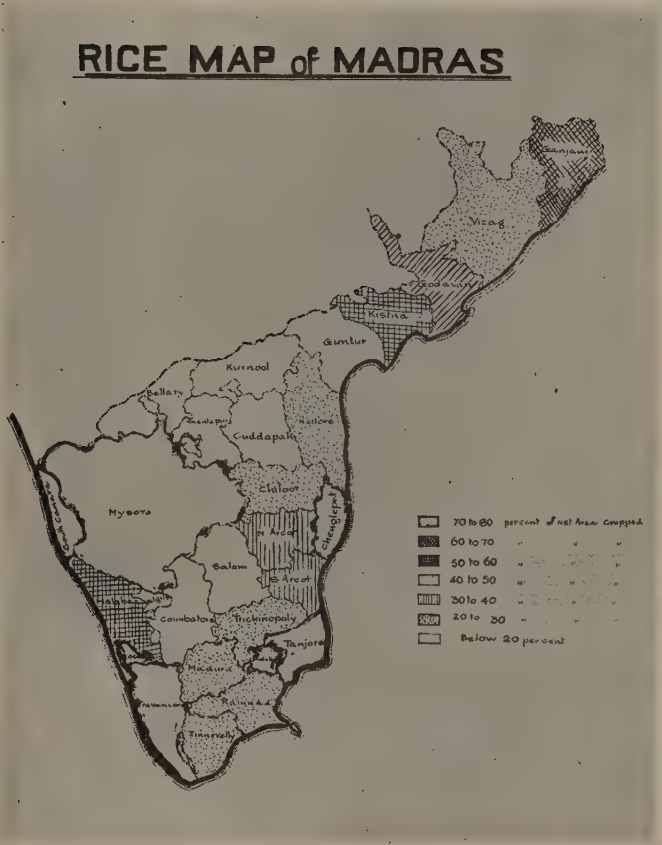
cultivators. Apart from a general interest in the new variety the Department does not interfere in any way with this individual. He simply multiplies the new selection and sells his crop for seed purposes to the people in his district. He usually receives a premium of 10 to 15 per cent. above the local market price of padi for his seed. It is very note-worthy that the demand for "proved" varieties always exceeds the supply, and there is not the slightest difficulty in distributing a good padi once it has definitely shown its worth. As an instance of rapid and successful spread of a new strain, it is stated that the selection known as G.E.B. 24 occupied an area of only 5 acres in 1926-27 season in one of the tracts but had, by the 1930-31 season, spread over 15,000 acres. The grower's keenness for better varieties is ascribed partly to the fact that he has never yet found his confidence in Departmental advice misplaced. The greatest care is always taken to test a new variety in the district where it is to be grown before its general distribution is permitted.

Organization of Padi Work in Madras.

The headquarters of the Department of Agriculture are situated in the city of Madras, but the Division in charge of rice work has headquarters at Coimbatore, some 300 miles to the south-west of the capital. The reason for this is that the Agricultural College of Madras University is situated at Coimbatore. Suitable research facilities are thus provided for Departmental officers, who in turn are in a position to afford technical training to students. Also, post-graduate students are in a position to receive advanced technical training while at the same time dealing with research problems under the guidance of specialists. This system has the further advantage that prospective applicants for appointments in technical divisions are in close touch with the work in progress throughout their university and student research periods.

A further advantage of Coimbatore as a headquarters lies in the fact that it is centrally situated with regard to the main padi-growing districts of Madras, though Coimbatore itself is unimportant as a rice-growing province.

The Rice Section of the Department carries on work on padi in all its aspects, systematic, agronomical, physiological, genetical and cytological. In addition to purely economic work, fundamental work on the genetics and cytology of rice is carried out at the Coimbatore station directly under the supervision of the Padi Specialist. There are four stations, one in each of the important padi-growing tracts of the Presidency, and each under the direct charge of a resident Superintendent who has a considerable trained subordinate staff to assist him. Work on these sub-stations is mainly directed towards improvement in yield by the evolution of improved strains and by investigation of agronomic practices suitable to the particular tract in which the sub-station is situated. The more fundamental and technical work is confined to the central station at Coimbatore.



(Published by courtesy of the Director of Agriculture, Madras.)

RAISING F_1 PLANTS IN POTS.

(By courtesy of the Director of Agriculture, Madras.)

The staff of the Division consists of the Padi Specialist, four station superintendents, each of whom is a post-graduate officer fully trained in modern experimental and statistical methods, about a dozen highly-trained assistants who are mostly post-graduates with experience of research work, and several field clerks. In addition to the above, there are also research students of Madras University engaged in technical laboratory work at Coimbatore.

Work Done and in Progress.

During the twenty-two years since the Division was constituted, an enormous amount of general and specialized rice work has been accomplished. Much of it has been recorded in *The Indian Journal of Agricultural Science*, some of it in special pamphlets and bulletins and some in special memoirs. The main lines of work done and still in progress may be briefly summarized as follows :—

(1) *Agronomical.*

(a) *General Reduction of Seed-rate.* Formerly it was the usual practice for cultivators to use from 50 to 100 lbs. of seed in the nursery for each acre of land to be planted. One of the first investigations of the Division was on the question of seed rate, and it was found that with reasonably economical use 20 to 25 lbs. per acre were ample. The more moderate seed-rate has been widely advocated throughout Madras, and it is now uncommon to find excessive wastage of seed-padi under normal conditions. It is estimated that the annual saving in rice thus attained is enough to feed the whole population of Madras for one week.

(b) *Manurial.*—A large number of manurial trials have been carried out during recent years under much the same conditions as those carried out in Malaya. These experiments are still in progress, though it was understood that, in general, results are similar to those attained in this country; that is to say, the use of artificial fertilizers is generally uneconomic. In some cases significantly good results have been obtained from the use of superphosphate or bone-meal in soils which are believed to be deficient in phosphates. A light top-dressing of ammonium sulphate has generally given some increase in yield, though it is considered uneconomical to apply this dressing in areas where the yields are below 3,000 lbs. per acre. In the best delta areas where yields are very high, the use of a light dressing of ammonium sulphate is becoming fairly common. Experiments on the use of lime (at rates of 500 lbs., 1,000 lbs. and 2,000 lbs. per acre) applied just before transplanting, are at present in progress. The chief successes in the way of manurial experiments have been achieved by the growing of green manures. It has long been the custom in India to apply heavy dressings of green material, usually the leaves of forest and roadside trees, before preparation for padi. The Department of Agriculture therefore conducted a number of experiments with green manures grown on the land during the off-season. The results were most encouraging, and it was found possible to establish green manures in most areas where a little water could be made available for starting growth. The growing of such manures has been readily

accepted by the cultivators and the practice is rapidly spreading wherever conditions are suitable. The most commonly used crops for this purpose are *Tephrosia purpurea, Crotalaria juncea, Sesbania aculeata* and *Phaseolus trilobus*, the selection of the particular species depending on the soil and other local conditions. It appears that the general tendency now is to abandon manurial trials with artificial fertilizers and to concentrate on the distribution of seed of green manures; in fact, little more can be done on the question of fertilizers until the "limiting factor" has been further investigated.

(c) *Broadcast-seeding, Transplanting and Spacing.*—Experiments on the relative merits of broadcast versus transplanted crop, of seedlings transplanted at different ages, and of seedlings transplanted at the same age but at different spacings, have been in progress for several years. The indications so far are that there is a definite advantage in transplanting, as a transplanted crop gives significant increases over a broadcast crop except in special tracts. No definite results regarding spacing are yet available.

(d) *Nursery Methods.*—Experiments on different types of dry and wet nurseries and on the application of manures in the nursery are in progress.

(e) In addition, general experiments have been made, or are in progress, on the relation of cultural practice to lodging, on the effect of planting date on yield, on the growing of padi with reduced water-supply and on the comparison of root-systems of various varieties.

(2) *Selection and Breeding.*

(a) *Selection.*—Most of the important selection-work has been done since 1920. The important selections (*i.e.* those which have attained general popularity) are eight in number, and the general increase in yield resulting from the use of these selections is reported to be between 8 and 15 per cent. over unselected varieties. The main advantages of these varieties, apart from increased yields, are better quality of rice, a higher proportion of shelled rice to padi, slightly quicker maturity, and, in one or two cases, some degree of disease-resistance. Selection is done in the field and pure lines are isolated, grown, and tested at the Rice Stations in a manner similar to that practised in Malaya.

(b) *Breeding for Disease Resistance.*—A variety known as 'Korangusamba', extensively grown in Tanjore, is highly susceptible to a widespread disease known as Padi Blast (*Pericularia oryzae*). Two selections at Coimbatore had been found resistant to the disease and were therefore crossed with Korangusamba. Selections from the hybrid progeny have proved to be resistant to the disease and at the same time to give higher yields than the original Korangusamba. (*Piricularia oryzae* has never yet been recorded on rice in Malaya).

(c) *Breeding.*—The raising of new varieties by controlled breeding is a comparatively new development. A number of hybrids have reached the stage of trials against previous standard selections and results appear to be promising. A very satisfactory breeding technique, giving successes to the extent of over 90 per cent., has been evolved. This technique consists essentially in bagging a panicle in brown paper early in the morning. The

PREPARATION OF SEED-BEDS FOR SINGLE PLANT LOTS.

(By courtesy of the Director of Agriculture, Madras.)

SEED-BEDS OF SINGLE PLANT SELECTIONS READY FOR TRANSPLANTING.

(By courtesy of the Director of Agriculture, Madras.)

rapid rise of temperature within the bag causes premature emergence of the anthers before they are ready to dehisce. Emasculation thus avoids any interference with the delicate glumes, and crossing can be done later when the stigmas emerge.

(3) *Genetical Studies.*

(a) Very extensive work of a fundamental nature on the inheritance of various characters has been carried out. Over a hundred genes controlling morphological and metrical characters have been identified and studies are in progress on their linkage relations. The mode of inheritance of colour (in leaf stem, glumes, stigma, and seed), of size and shape of grain, of plant hight, of rapidity or otherwise of maturity, of panicle-length, of intensity of tillering, of strength of straw, of resistance to *Piricularia oryzae*, and of other characters has been investigated and demonstrated.

(b) Concurrent with the genetical studies, accurate cytological investigations have been carried out. These have concerned chromosomal aberrations in interspecific crosses, chromosomal irregularities in dwarfs, sterile plants and artificial mutants, the formation of chromosome rings and other highly technical cytological problems which are outside the scope of a general report.

(c) At present an investigation on the effect of X-ray treatment of seed in the production of mutations is in progress. Very rare natural mutants (such as those exhibiting chlorophyll deficiency) can be artifically produced by exposure of seed-padi to X-rays in varying doses and some interesting results are anticipated.

(d) A recent investigation into the question of heterosis in padi confirms the results obtained with many other crops; *i.e.* that the F_1 progeny of a cross frequently exceed both parents in general vigour and yield. This problem is undergoing further investigation.

(4) *Physiological Studies.*

(a) Experiments on the "vernalisation" of padi are in progress along the same lines as in similar experiments with other cereals in Russia. This may have some practical application in India where in some districts a shortening of the growing season is of paramount importance, but would seem to be of little value in Malaya where a slight shortening or lengthening of the maturation period is immaterial.

(b) *Root Studies.* Preliminary investigations into the development of root-systems of a few selected varieties of padi under different cultural treatments were undertaken during the last season. It was observed that (1) the zone of root-formation is lower in the soil in the case of transplanted padi than in the case of padi not transplanted; (2) a "floating" variety of padi which is particularly prone to lodging has a relatively poor root-system; (3) the root-system is generally more extensive when grown under puddled conditions than under dry-land conditions; (4) the more frequent the irrigations given, the deeper and more extensive is the root-system; and (5) manuring

increases the bulk of the root-system. These investigations are being continued during the present season.

(c) *Influence of Environment on Size of Grain.* It has been found that certain pure strains of padi develop a coarser or finer grain according to the district in which they are grown. Investigations into the possible cause of this effect are in progress.

(5) *Collection and Maintenance of Varieties: Classificatory Work.*

A collection of over a thousand varieties of padi has been formed both from local and foreign sources. This collection is maintained more or less as a living herbarium. The great majority of varieties are grown as pure lines each year. The collection includes varieties from temperate climates (North America and Italy) but such as have been tried are failures from the commercial point of view as the local climate causes premature flowering. Similar results have been obtained in Ceylon and Malaya. Each variety grown is described in detail every year and the record carefully preserved. This would seem to be a laborious and perhaps unnecessary routine, but it has the advantage of ensuring that varieties are kept true to type. It also gives valuable training in accurate observation and description to the younger research Assistants. A collection of this magnitude requires a fool-proof yet simple system of recording and it has been found satisfactory to grow each variety under a type number each season. The single plant selections made for inheritance studies and for evolving economically useful strains are given individual numbers which run consecutively from 1 to 10,000. When a series is exhausted, a new series is started. At present the second series of 10,000 is nearing completion. A numbered page in the record books is allowed for each variety every season and it is a simple matter to 'carry forward' and record the number under which any given variety was grown during previous years. It is thus easy to refer back to any season for information about a variety then grown.

A certain amount of systematic classificatory work has been done at Coimbatore, but as elsewhere, the officers concerned have found it very difficult to devise a satisfactory and accurate system. There is so much intergrading of characters, while the morphological features of padi may be so greatly influenced by environment, that the general opinion seems to be that any but the broadest of classifications are, even if possible, hardly worth the trouble. In actual practice, officers regularly dealing with padi can more readily classify a variety by eye than they could by the use of key-tables or by reference to descriptions.

Rice Station in Madras.

The four rice stations under the control of the Department of Agriculture are as follows :— Tanjore in the Caveri Delta (area 55 acres), Maruteru in the Godavari Delta (area 50 acres), Potambi on the Malabar coast (area 110 acres), and the central station at Coimbatore (area 30 acres).

TRANSPLANTING COMPARATIVE TRIALS, COIMBATORE.

(By courtesy of the Director of Agriculture, Madras.)

METHOD OF "SELFING" RICE-PLANTS.

(By courtesy of the Director of Agriculture, Madras.)

The two stations visited were the central station at Coimbatore and the Pattambi station on the Malabar coast. Visits were not paid to the Delta stations as it is stated that they are similar in organization and purpose to the Pattambi station.

Coimbatore Central Station.—This station, which has been in existence for about twenty years, has an area of thirty acres and is situated about two miles from the main buildings of the Agricultural College. The land is very slightly sloping and consists of fairly good medium-heavy soil. It is enriched annually by the growing and ploughing in of leguminous green-manures (*Crotalaria juncea, Sesbania aculatea* and *Phaseolus trilobus*). Apart from rain, water is obtained from a local seasonal river, supplemented by four large storage tanks. Two of the latter are fitted with motor-pumps for occasional use, though, except in emergency, bullocks are used for raising the water to ground-level. The station is divided into ten main blocks, each of which is subdivided by means of bunds into small level fields. It is interesting to note that, in the demonstration area, the bunds are cut with a vertical side facing downhill, and a slope of about 60 degrees facing uphill. In re-forming bunds, earth is always cut from the lower side and piled on the upper in order to counteract the tendency of the bunds to move slowly downhill and thus, in the course of years, to alter the position of the fields. A small portion of the station which is situated in high land is being utilized for breeding work on tomatoes, chillies and egg-plants. Five acres of padi land are used as a demonstration area.

The permanent buildings of the station consist of a combined office and field laboratory, a large and particularly well-equipped store, housing for cattle and a rat and bird-proof breeding-cage. There are, in addition, several small stone-faced threshing and drying-floors.

Features of interest noted were as follows :—

(1) The very convenient method of storing seed-padi. Single plant seed is kept in a glass-bottle with metal screw-on tops. Pure line seed is stored in larger zinc cans, and bulk crop is stored in large cylindrical bins which have a capacity of over 200 lbs. of padi.

(2) Loss of seed through the ravages of grain-moth can be prevented by covering the padi in the bins with a layer of fine sand which prevents the re-entry of moths into the padi after their emergence. This is simple, cheap, and does not prevent the padi being used for food if it is not required for planting. (Chemical insecticides may make the padi unpalatable).

(3) The method of growing pure-lines under type numbers, (to which reference has already been made), and the very neat and absolutely permanent records kept in strong record ledgers.

(4) The disinfection of all seed with "Cerosan" immediately prior to sowing as a precaution against attacks of "foot-rot" (*Fusarium moniliforme*). (Apparently unknown on padi in Malaya).

(5) The germination of all single plant seed in glass bottles, each containing a waxed numbered label, prior to sowing.

(6) The good growth of seedlings in the general nurseries. Seedlings are watered with ammonium sulphate solution about a week before transplanting. This appears to give a remarkable stimulus to their growth, particularly if the rain is late.

(7) The preparation of seed-beds and sowing of single plant cultures. The beds are prepared with very great care to a size of 4 ft. x 3 ft. Each bed is divided from its neighbour by a partition of mud, and a small drain is formed between each row of beds. Before the seed is sown, the nursery beds are flooded to a depth of about two inches and each bed is numbered with a metal label. Bottles containing the germinated seed and waxed numbered label are distributed to the appropriate beds and the seed sown by reliable assistants. At the time of visiting, a dozen labourers were occupied in preparing nursery beds, and ten skilled assistants were sowing seed. It was stated that, by this organization, 800 single plant lots could be sown in about three hours with practically no chance of error.

(8) The slashing and incorporation of green-manures by ploughing and the harrowing and levelling of the land were noted.

(9) A number of species of rice other than *O. sativa* were seen growing together with interspecific crosses and with various abnormal plants (haploids, triploids and polyploids) which were being grown in connection with investigations into chromosomal irregularities.

(10) The growth of mutants (in particular the chlorophyll deficient mutant induced by X-ray treatment of the seed) was noted in the breeding-cage.

Pattambi Sub-station.—This station, with an area of 83 acres, is situated to the west of the Ghats in the Malabar Province about 60 miles from Coimbatore. It consists of a strip of a broad shallow river valley together with some of the higher hill-land adjacent to the valley. The soil is of a lateritic nature, gravelly, shallow and generally deficient in organic matter. It overlies a formation of what appears to be true laterite. The greater part of the station is devoted to padi, but a small portion of the unirrigated high land is occupied by other crops, which, however, are grown mainly in rotation with dry padi.

The buildings, which are particularly well-constructed and maintained, consist of a supervisor's office, a clerical office, a large laboratory, a store, a general work-room, bullock-sheds and the usual outdoor buildings.

The station is divided into four main sections as follows :—

(*a*) Dry land not utilized for padi. There are a few acres devoted to orchard and reserved for later construction of quarters for the staff of the station.

(*b*) Dry land utilized for padi. The higher slopes and the tops of the low hills at the sides of the Stations are utilized for dry padi which is grown once in two or three years in rotation with other crops, thus conforming with the local custom.

(*c*) The terraced and irrigated slopes on which one crop of padi is grown annually between June and October.

TEMPORARY STRAW STACKS FOR STORING PADI USED IN RICE MILLS.

(By courtesy of the Director of Agriculture, Madras.)

NATIVE GRAIN-STORE MADE OF PLASTERED BAMBOO MATS ON A RAISED PLATFORM.

(By courtesy of the Director of Agriculture, Madras.)

(*d*) The low land at the bottom of the valley which has deeper and better soil and is irrigated from the river during the monsoon season. The crops of padi are grown on this land between June and January.

The following features of interest were noted :—

(1) A manurial trial with dry padi. The randomized block system was being used and treatments consisted of dressings of cow-dung at rates of 1,000 lbs., of 3 tons and of 6 tons per acre against an unmanured control. The padi was nearing the flowering stage, but the experiment appeared to be unsuccessful owing to the poor and irregular growth of the crop.

(2) A trial area of pineapples (Kew variety) grown at different spacings and planted in trenches of different depths. This crop is being recommended for inclusion in the rotation with padi.

(3) Trials of sugar-cane grown under differing irrigation.

(4) Several varieties of plantains being grown for inclusion in the rotation with rice.

(5) Investigations into the life-history of *Striga lutea* Lour., a parasitic Angiosperm which commonly grows attached to the roots of hill-padi, with special reference to possible methods of control.

(6) A strip-trial which had been laid out on the terraced irrigated beds to test the difference in yield between broadcast and transplanted padi. Broadcasting seed is a common local custom. Previous trials have shown transplanted padi to be superior to that of broadcast.

(7) The transplanting of seedlings in multiplication blocks on the terraced land which was in progress at the time of visiting.

(8) The transplanting of the general varietal collection which was in progress on the flat land of the Station at the time of visiting.

(9) Strip-trials to test yield of selections against standard varieties had been recently transplanted.

(10) Seedlings for bulk-trials were being transplanted to obtain yield figures of new varieties, and to obtain seed for distribution.

(11) A manurial trial on the wet land was being laid out to determine the effect of varying dressings of lime applied just before transplanting. (Method, randomized blocks; treatments, 500 lbs. 1,000 lbs., 2,000 lbs., of lime per acre and untreated control).

(12) An experiment to determine the effect of spacing on yield. This experiment was duplicated, two varieties of padi being utilized. Spacings on trial were 3 ins. x 3 ins., 6 ins. x 6 ins., 8 ins. x 8 ins. and 12 ins. x 6 ins. The replicated strip method was being used.

(13) An experiment to determine the effect of season on yield of padi. Sowings of padi are being made every three weeks throughout the year in an attempt to correlate meteorological data with yield.

(14) The system of numbering and recording varieties grown. This was kept in the same way as at Coimbatore Station.

General Conclusions on Visit to Madras with Special Reference to Malaya.

1. The area of land under rice in Madras is approximately 11½ million acres and average yield is estimated to be about 1,800 lbs. (equivalent to 330 gantangs) per acre. The rice-area of Malaya is about three-quarters-of-a-million acres and average yields of the best rice-land are similar to those of Madras.

2. One of the most important factors in rice-cultivation in Madras is the seasonal distribution of rainfall. This results in the general popularity of varieties of shorter maturation-period than are common in Malaya though long-term varieties are grown under exceptional conditions.

3. Owing partly to the association of the Rice Research Division of the Department of Agriculture with the Agricultural Section of Madras University, research has for some years been of a fundamental and 'long-range' nature.

4. Among other problems, rice research has been mainly directed towards the study and improvement of cultural practices, methods and effects of manuring, morphological and physiological studies of varieties, general and cytological research, and selection and hybridization.

5. Results of manurial experiments tend to confirm those obtained in Malaya—that in general the use of artificial fertilizers is uneconomical, particularly at the present low price of the crop produced. Attention is being turned towards the growing of green manures in the off-season and satisfactory results are being obtained in this direction.

6. Selection has provided a number of useful varieties capable of giving increased yields of between 8 and 20 per cent. over the unselected varieties formerly grown. Selections of Malayan varieties have given similar increases.

A considerable proportion of the total area of rice land in Madras is now regularly planted with selected strains. About thirty selections are grown commercially and of these eight are grown on a large scale. In addition to increased yield, certain selections give a better quality of rice, a higher proportion of rice to padi, a slightly shorter maturation-period and in several cases, resistance to disease.

7. Hybridization is a comparatively recent development and trials of the hybrids which have been obtained are giving promising results.

8. The readiness of the Madras cultivator to accept new varieties and advice is a noteworthy feature of the agriculture of the country. It is stated to have resulted in a considerable increase in the general average yield of rice throughout Madras during the last two decades.

The writer wishes to record his appreciation of the readiness with which the Director of Agriculture, Madras, granted permisssion to visit Coimbatore, and of the kindness shown and help given by the Padi Specialist and his staff at Coimbatore and Pattambi.

The illustration are the property of the Department of Agriculture, Madras, and are published by permission of the Director.

MILLING TESTS OF PURE STRAIN PADI IN PERAK.

Compiled from information supplied by the Agricultural Staff of the State of Perak and by the Assistant Botanist.

In 1933, attention was drawn in this Journal* to the necessity for improving the quality of locally-produced and milled rice so that it could compare favourably with that of imported rice. One of the conclusions then reached was that the inferior quality of locally-milled rice was due to it being derived from mixed padi, while in the case of imported rice, mixture of types of grain is much less apparent.

Arrangements were accordingly made to have milling tests carried out on recognized strains of padi which, after prolonged experiments in the field, have proved suitable for cultivation in Malaya from the point of view of yield and planting conditions.

The tests were carried out at the Government Rice Mill at Bagan Serai, the first test being made with a mixture of Seraups 36 and 48 and Radin 4. The original intention was to mill the Seraups 36 and 48 together, but owing to a misunderstanding the Radin 4 was included in the mixture. The Radin 4, which is a much smaller grain than the Seraups, separated out unhusked to a considerable extent, and had to be returned to the huller; this undoubtedly affected the amount of breakage in the finished sample.

Three samples of this rice were examined for breakage and gave an average of 23 per cent. of broken rice as compared with 52.5 per cent. from mixed grain, the percentage originally recorded from samples from the same mill in the article already referred to. This analysis, therefore, showed clearly the beneficial effect of a more uniform padi on the quality of the resulting rice.

A further test was made with padi of a single pure strain only, Seraup 48, and the resulting rice gave the satisfactory figure of 15 per cent. broken rice, a considerable improvement on the mixed padi used in the first test.

A third series of milling tests was carried out with seven pure strains of padi, and the table following gives the result of these tests together with the results of the earlier tests for comparison.

From consideration of the results obtained in the third series of milling tests it is evident that such qualities as thorough drying and ripeness of grain are of great importance. This is shewn by the different results obtained with Seraup 36 and Radin 4. No explanation is forthcoming regarding the difference between the two samples of Seraup 36, but the comparative inferiority of the Talang sample of Radin 4 is doubtless due to unevenness in ripening which was a feature of Talang during the season.

* The Characteristics of Malayan Milled Rice, *Malayan Agricultural Journal*, Vol. XXI No. 12, page 674.

Milling Tests of Pure Strain and Mixed Padi.

Series of Tests.	Strain of Padi.	Station of Origin.	Percentage of Breakage.
Original Result	Mixed	...	52.5
First	Seraups 36 and 48 and Radin 4 (mixed).	...	23 *
Second	Seraup 48	...	15 *
Third	Seraup Besar 15	Talang ...	24
	Radin 7	Titi Serong ...	25
	Radin 4	Titi Serong ...	9
	Radin 4	Talang ...	27
	Siam 76	Talang ...	19
	Mayang Ebos 203	Briah ...	19
	Seraup 36	Titi Serong and Bagan Serai ...	7
	- do -	Kuala Kurau ...	13
	Siam 29	Selinsing ...	6

The opinion is expressed, in connexion with the last series of tests, that better results might have been obtained if the padi had been stored and dried more completely. Support for this view is provided by the excellent result obtained from Siam 29 which had been stored much longer than the other strains. The Manager of the mill considered that the rice milled from Siam 29 was fully equal to Siam No. 1 rice, and a sample of the latter gave 8 per cent. breakage as compared with 6 per cent. recorded above. This result is extremely satisfactory in view of the steps now in progress to endeavour to get this strain planted extensively in South Krian.

In view of the satisfactory results of the milling tests described above it was decided in February, 1935, to approach the Board of Directors, Government Rice Mill, Bagan Serai, with a proposal that the mill should pay a small

* These percentages were obtained as an average of separations carried out with the Colis Separator; the breakage percentage of the Seraup 48 in the second test by hand-picking was 20. The percentages given for the third test were all obtained by hand-picking.

premium for reasonably large quantities of approved pure strains of padi. As a result the Board agreed to pay a premium in 1936 of half a cent a gantang above the current market price to an approved land owner, provided he undertook to plant up that portion of his estate suitable for the particular strain of padi in question, and that he offered the whole of his resultant crop, less what would be required for seed purposes the following season, to the Government Rice Mill, Bagan Serai. The Board also agreed that if owners of small areas of padi land in blocks of reasonable size would agree to the same terms, they too would be entitled to the same premium for unadulterated supplies of pure strain padi.

Negotiations with land owners were commenced and contracts drawn up on these lines; as a result, the owner of 1,000 acres in North Krian has arranged for 700 acres of his land to be planted with Seraup 48.

A similar agreement has been entered into with five Malay padi planters in the Kuala Kurau mukim of Krian, who have planted a total of 56 acres with the same strain of padi (Seraup 48).

In both instances the seed was supplied by the Department of Agriculture at local market prices. It was hoped that similar arrangements could be made with padi planters in South Krian for the planting of reasonably large blocks of land with Siam 29, a variety suitable for the higher lands of this district, but it was found that the majority of planters in this locality had already arranged for their seed supplies, and that it was too late in the season to make satisfactory arrangements. However, if the present experiment proves successful, it should encourage further distribution in 1936, when the fact becomes known that the crop of certain cultivators is commanding a premium.

EFFECT OF SODIUM CHLORATE USED AS A WEED-KILLER AMONG OIL PALMS

BY
B. BUNTING,
Agriculturist
and
T. D. MARSH,
Assistant Agriculturist.

The use of sodium chlorate as a weed-killer has attained much prominence in horticultural practice in Europe within the last few years, with the result that consideration has been given to its employment for the destruction of weeds and cover crops, found to be harbouring rats, on oil palm estates in Malaya. As a result of enquiries as to the possible ill-effects of this chemical on the palms, a simple experiment was laid down at the Central Experiment Station, Serdang.

An area of 4 acres of ten-year-old oil palms in Block 21 was selected for this purpose. Owing to the presence of a hard pan at a depth of 2 to 3 feet below the surface the palms in this area are not in a vigorous condition; they were used in this experiment as they would be more likely to show the ill-effects of plant poison than would more vigorous healthy palms.

The experiment was conducted with four plots of one acre each, with palms planted 28 ft. x 28 ft. triangular, *i.e.* 64 palms per acre.

Plots (1) and (2) were clean weeded two weeks before the dressings were applied, while plots (3) and (4) were left under a grass and fern cover.

Series A—Light and Medium Dressings.

In the first series of experiments with light and medium dressings, the following mixtures were sprayed on the four different plots:—

(a) *Clean Weeded Plots.*

Plot (1) sprayed with 4 lbs. sodium chlorate in 32 galls. water.
Plot (2) sprayed with 8 lbs. sodium chlorate in 32 galls. water.

(b) *Unweeded Plots.*

Plot (3) sprayed with 4 lbs. sodium chlorate in 32 galls. water.
Plot (4) sprayed with 8 lbs. sodium chlorate in 32 galls. water.

The plots were sprayed on the 13th and 14th December, 1934, and spraying was repeated with the same concentrations on the 14th January, 1935.

Rainfall.—A table is attached giving rainfall during December, 1934 and January, 1935. These records show that 0.62 inches fell on the 14th and 1.23 inches on the 18th December, 1934. No rain fell after the second dressing until nearly one week had elapsed when 0.16 inches fell on the 19th and 1.58 inches on the 20th January, 1935. It is presumed that a fall of rain approximating to one inch after each spraying would distribute the poison through the soil.

Results.—On all the areas, no apparent damage to oil palms could be observed from the 4 lb. or 8 lb. dressings, and even "supplies" that had their leaves sprayed did not show any signs of browning.

The grass was "scorched" brown after the first dressing, and more so after the second dressings on both series of plots. Ferns, while scorched a little on the edges of the fronds, were not killed or seriously damaged by 4 or 8 lb. dressings.

Conclusions.—Two applications of sodium chlorate at an interval of one month applied up to 8 lbs. in 32 gallons of water per acre have no apparent deleterious effect on mature or immature oil palms. These observations were made six weeks after the second dressing of sodium chlorate was applied.

Series B—Medium and Heavy Dressings.

As the oil palms showed no ill-effects from the first two dressings it was decided to repeat the experiment on the same area with 7 lb. and 14 lb. dressings with different concentrations in each case instead of dressings of 4 lbs. and 8 lbs. in the same volume of water as applied in the first series of experiments.

In the second series of experiments with medium and heavy dressings, the following mixtures were sprayed on the various plots :—

(a) *Clean Weeded Plots.*

Plot (1) sprayed with 7 lbs. sodium chlorate in 25 gallons water.

Plot (2) sprayed with 7 lbs. sodium chlorate in 50 gallons water.

(b) *Unweeded Plots.*

Plot (3) sprayed with 14 lbs. sodium chlorate in 25 gallons water.

Plot (4) sprayed with 14 lbs. sodium chlorate in 50 gallons water.

The first application was made on the 1st and 2nd March, 1935, and the second on the 1st April, 1935.

At the time of treatment on 1st March the grass on Plot (3) was fairly green and had almost recovered from the effect of the previous dressings.

The grass in Plot (4) was recovering, but the growth was not so vigorous as that on Plot (3).

Heavy rain fell on the evenings of the 2nd, 4th, and 5th March, 1935, and observations made on the 7th March showed that scorching effect did not appear so severe as that caused by the earlier dressing on Plots (3) and (4), *i.e.* those applied in December, 1934 and January, 1935. A table showing the rainfall for the period March/April is appended for reference.

Observations made on the weed growth at the end of April showed that on Plot (3) the grass was all scorched brown, but green patches were reappearing at this stage. On Plot (4) the grass over the whole area still showed a scorched appearance and was recovering only to a very slight extent. The fern growth on Plot (3) presented a ragged and semi-scorched appearance, but on Plot (4) it was struggling to keep alive and much of the foliage had been killed outright; the roots, however, were little affected since young fronds

were then growing. It is significant that the scorching effect of the lower concentration on Plot (4) compared with Plot (3) was much greater and this may be attributed to the better distribution of the spray.

The areas that were clean-weeded in the beginning of December, 1934, had not required any weeding and they were still fairly clean at the end of April, 1935, although the weeds were spreading a little. Between December and April four sprayings were applied.

Further observations made on the 16th August, 1935 or 4½ months after the final dressing, showed that the oil palms had suffered no ill-effects even from the heavier dressings of sodium chlorate.

Although the experiment was primarily designed only to test the possible toxic effects on the palms, the following observations on costs of application and effect on surface growths may be interest.

The cost of the sodium chlorate (99.5 to 100 per cent.) packed in 1 cwt. drums is $19 per cwt., so that a dressing of 14 lbs. of the chemical costs $2.38 per acre.

Four labourers were employed for mixing and spraying the area of 4 acres on each of the four occasions on which the chemical was applied; consequently labour costs are 40 cents per acre for each dressing. It should, however, be mentioned that the precise methods adopted to ensure an even application of the solution to the various plots under experiment would be unnecessary in general estate practice, so that with a resultant larger acreage covered per labourer per day a lowering of costs might be expected.

On the above basis the cost per acre for the respective dressings would be as follows:—

4 lbs. per acre	=	68 cts.	+	40 cts.	=	$1.08	per acre per dressing.
8 „	=	$1.36	+	40 „	=	1.76	-do- -do-
14 „	=	$2.38	+	40 „	=	2.78	-do- -do-

It is estimated that the cost of weeding this area by manual labour would amount to about 60 cents per acre per month, so that the lightest dressing of sodium chlorate—4 lbs. per acre and 6 dressings per annum—would cost about the same as ordinary monthly weeding.

At the end of the experiment weeds and fern growth had become re-established on both the clean-weeded and the unweeded plots.

The maximum effect is apparently obtained when the dressings are applied during dry weather, consequently it is desirable to take advantage of dry seasons so far as possible.

Conclusion.

The experiments prove that two dressings of 14 lbs. of sodium chlorate at intervals of a month have no harmful effect on the growth of oil palms. Further, although Plot (4) in the two series of experiments received a dressing of 44 lbs. of sodium chlorate per acre in the aggregate, the palms in the area showed no ill-effects as a result of this comparatively heavy application.

Records of Rainfall during Sprayings.

Dates.	A-First Dressings of 4 lbs. and 8 lbs. Sodium Chlorate.		B-Second Dressings of 7 lbs. and 14 lbs. Sodium Chlorate.	
	Dec. 1934	Jan. 1935	Mar. 1935	April 1935
	Inches	Inches	Inches	Inches
1	0.10	0.94	0.05	0.05
2	—	—	0.40	—
3	0.18	—	—	0.30
4	—	0.77	0.62	0.07
5	0.35	—	0.35	0.60
6	—	0.08	—	0.13
7	—	1.56	—	0.06
8	—	—	—	—
9	—	—	—	—
10	—	0.01	0.44	1.70
11	—	—	—	0.05
12	—	0.49	0.75	0.06
13	0.02	0.01	0.61	0.75
14	0.62	—	1.12	1.00
15	—	—	1.55	1.41
16	0.01	—	3.57	0.25
17	—	—	1.41	0.30
18	—	—	0.35	0.05
19	1.23	—	0.23	0.02
20	—	0.16	0.80	0.62
21	—	1.58	0.17	0.06
22	0.24	—	—	0.57
23	0.90	—	0.44	0.32
24	0.41	—	0.15	0.15
25	—	—	—	—
26	0.01	—	—	—
27	—	0.50	—	—
28	0.60	—	0.01	0.05
29	—	—	0.07	—
30	0.21	—	—	0.05
31	0.49	—	0.33	—

Danger of Fire with Sodium Chlorate.

It is necessary to issue a warning regarding the properties of sodium chlorate; any clothing or sacking impregnated with a solution of the chemical should be thoroughly washed after spraying, since textiles will be rendered highly inflammable after the spray evaporates.

The liability to an outbreak of fire among the destroyed weeds should also be guarded against by raking the loose dead material into isolated heaps as soon as possible after spraying.

TWENTY-FOURTH REPORT ON NATIVE RUBBER CULTIVATION IN THE NETHERLANDS INDIES.

Third Quarter 1935, with additional data up to the end of October, 1935.*

Prices.

In the early part of the third quarter, the price of Java Standard Sheet in Batavia dropped within a few days from 18½ guilder cents to 17¾ cents per ½ kgm., the latter price level being maintained during the remainder of July. During August, the price improved to 18 cents, after which a decline followed till 16th September, when it reached the low level of 16¾ cents per ½ kgm. Subsequently, a gradual improvement set in till at the end of the month the quotation was 17¾ cents. The half-monthly average quotations during the quarter were—in guilder cents—18.0, 17.8, 18.0, 18.0, 17.4, 17.3. In October, the average reached a considerably higher level, being 18.3 cents for the first half of the month and 19.6 cents for the second half.

Earlier fluctuations were attributed to variations in the stock position, shipments, and exports, in the Netherlands Indies and Malaya. The recovery was caused by the International Rubber Regulation Committee reduction of the export percentage for the last quarter from 65 to 60 per cent., followed by the report of increased American consumption figures. In this connexion also mention should be made of the effect of the acquisition by the Netherlands Indies Government of 20,000 tons of estate licences with a view to compensating for the excess exports of native-grown rubber, and the very determined application of the extraordinary export duties.

The extraordinary export duty was reduced from 21 to 20 guilder cents per kgm. on July 22nd, in view of the declining market prices. On September 30th, increasing prices and the large amounts of native-grown rubber that were being exported, necessitated the raising of the tax to 22 cents per kgm.

The price increase in October was counterbalanced by rises of the extraordinary export duties which rapidly succeeded one another; effective on October 13th, 18th, 23rd and 30th the duty was raised to 23, 24, 25 and 26 guilder-cents per kgm. respectively, the principle followed in each case being that the difference between the market price of Java Standard Sheet in Batavia and the extraordinary export duty (the theoretical basic price) should be kept, as far as possible, constant. In the first few months of the year 10 guilder-cents per kgm. was still being taken as the basic price for working out the extraordinary export duty, but this figure, in view of the large amounts being exported by the native growers in excess of the quota they had been allotted, which quota was still further reduced in the course of the year, had to be brought down to 8 cents in July. For similar reasons the basic price was fixed at 7 guilder-cents for calculating the duty in September. The high

* Abstract from *The Netherlands Indies*, Vol. III No. 24, December 16th, 1935.

exports (17,764 tons) in October made it necessary to reduce the basic price again and on November 10th a price of 6 cents was used in fixing the extra-ordinary export duty at 29 cents. Beginning with the revision of the extra-ordinary export duty of June 16th, the time between the announcement of a revision and its going into force was reduced to three days for wet rubber, to two weeks for dry native-made sheets and five weeks for blankets. These so-called "deferment periods" were reduced to 2 days, 12 days and 30 days respectively with the latest increase in the export duty (which took effect on November 11th).

Production and Exports.

The following table shews the monthly production and exports of native grown rubber during 1935.

Production and Exports of Native-grown Rubber during 1935.

Month	Total Exports	Movements of Stocks held by Recognised Exporters	"Corrected" Figures showing Production
January ...	9,817	—3,378	6,539 (Ramadan)
February ...	17,176	—5,260	11,916
March ...	9,025	+1,536	10,561
April ...	13,804	— 675	13,129
May ...	22,588	—3,481	19,107
June ...	14,488	—1,470	13,018
July ...	8,227	+1,290	9,517
August ...	9,870	+1,255	11,125
September ...	9,763	+ 947	10,710
October ...	17,764	—3,400	14,364

The export figures for October shew a sudden rise, which is primarily to be attributed to a considerable clearance of stocks, both visible and invisible, as a result of the reduction of the theoretical basic price from 8 to 7 guilder-cents per ½ kgm. on September 30th. This reduction only became effective for sheets two and blankets five weeks after that date. The clearance, then, principally affected these dry rubber qualities. For this reason, the export figures do not present a correct picture of the production of rubber.

The increased level of production is accounted to the increasing number of small-plantation owners who have begun to participate in the production, as well as to the tapping by those who are dependent on the income they derive from rubber for their livelihood.

Dry rubber is acquiring a constantly higher percentage in the total exports. The remilling factories and the natives themselves are contributing to an approximately equal extent to this development. During the third quarter 10,230 tons were exported by remillers, while the exports of the dry product manufactured by the natives totalled 9,514 tons.

Local Reports.

The following Districts are now under individual restriction schemes :— Acheen and Dependencies, Tapanuli, Sumatra East Coast (excluding Bengkalis), Rhio and Dependencies (Free Area), Bangka and Dependencies. These Districts exported during the quarter 2,755 tons (dry equivalent) of native-grown rubber, 256 tons of which were still subject to the payment of the extraordinary export dues. The exports from January to October inclusive were 780 tons below the allotted amount.

Regions with the extraordinary export duty system are: Sumatra East Coast, Division of Bengkalis; Sumatra West Coast; Rhio, Indragiri; Palembang; Jambi; Western Borneo. Exports from all these areas during the third quarter were appreciably lower than during the previous quarter. In all these districts the activities leading to the registration and classification of rubber trees, with a view to the introduction of the individual restriction system wherever possible, are being pushed energetically.

IMPERIAL FRUIT SHOW, 1935.*

This year the Imperial Fruit Show and Canners' Exhibition which lasted from October 25 to November 2, was held at Cardiff.

The close connexion that exists between the South Wales tinplate industry and the canning side of the fruit and vegetable trade made the choice and locality a very suitable one.

For the main purpose of the Malayan stand, which was, as in previous years, to advertise Malayan pineapples, the dense industrial population in and around Cardiff could hardly have been improved upon.

This was the fifteenth annual show and the most ambitious of the series, embracing every section of the fruit-growing industry in the Home Country, the Dominions, and the Colonies. Producers from all parts of the Empire entered more than 2,000 exhibits for competition in the 122 classes provided, and cash and other prizes to a value of £1,500 were distributed.

The Malayan stand, although the smallest beyond comparison of the Government stands and the only one neither regularly giving nor selling samples, proved very popular. This was chiefly due to the cookery demonstrations given throughout the day, showing the many ways in which pineapples can be prepared for the table. The publicity material, selected in the light of nine years' experience, also proved a great attraction, while the Agency was fortunate enough to secure broadcast mention before the show and considerable publicity during its course in the local press. At the conclusion of each demonstration tasting samples were distributed and pineapple recipes given on request. It would be hard to imagine a more effective means of propaganda among those who form the bulk of the consumers.

Although this is designedly a popular show, chiefly catering for the general public, the stand was visited by a large number of grocers whose enquiries as to prices, qualities, etc. were dealt with and for whom tins were opened on the spot. They were highly impressed by the colour and fine flavour of the "Golden" pineapple displayed on the stand. It was interesting to find, at this Show as at the Grocers' Exhibition, that most of them possessed quite a fair idea of recent developments in the pineapple-canning industry in Malaya, gathered from the Agency's articles in trade papers.

During the current year a good deal of publicity has been secured for Malayan pineapples when it is taken into account that no funds have been available for advertising: a National Broadcast on increasing their use, which elicited some 3,000 letters; stands at one International and one Imperial Exhibition; articles in trade and other publications; and the distribution of 10,000 sets of pineapple recipes.

---

*Abstract of Report from the Malayan Information Agency.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports submitted by Field Officers.

December, 1935.

The Weather.

In Kedah, Penang and Province Wellesley the weather was normal for the month, the first half being wet and the second half drier, but the rainfall in Kedah was above average. Elsewhere, with the exception of the east coast, the month was normally wet with some local variations both above and below average precipitation. Thus in Krian and in an area comprising the Tampin District of Negri Sembilan, all Malacca and the northern inland portion of Johore the rainfall was well above average. On the east coast precipitation was slightly deficient in Kelantan, about half the average in the Kuantan and Pekan Districts of Pahang, and even further below normal on the coast of Johore.

Remarks on Crops.

Padi.—Transplanting was completed, with the exception of a few late areas in the Panchang Bedena district. Harvest was completed or in full swing in the riverine padi fields below Kuala Lipis in Pahang, in the Batang Padang District of Perak, the inland Districts of Selangor, the Jelebu District of Negri Sembilan and several parts of Johore. Harvest was commenced in North Kedah, Province Wellesley North, parts of Kuala Pilah and Tampin Districts in Negri Sembilan and part of the Alor Gajah District in Malacca.

Crop prospects in general remain good, except in the Central District of Province Wellesley and in most parts of Johore; in both, weather conditions early in the season were not favourable, while in Johore rats and birds did serious damage. Continuous rains during the month in Krian have resulted in rather deep water in the padi fields and if the rains continue there is danger that part of the crop will lodge. In the new irrigation area of Sungei Manik the crop is reported as very promising, while in the Panchang Bedena area some 7,000 acres are reported to have been planted, with further late areas not yet planted. In this recently developed district rats are very numerous and there is a danger that they may cause considerable damage, in spite of the efforts to reduce their numbers made by the Rat Destruction Officers and the local growers.

In Kelantan good, but not excessive, rainfall has much improved the condition of both the wet and the dry padi crops, and yields are expected to be good.

The Temerloh mill obtained only sufficient supplies of padi to work for one day, but further supplies are expected to be forthcoming now that the harvest is nearly completed.

Organized hunting of wild pig has materially reduced the losses of padi caused by these animals in the Temerloh District of Pahang.

Rubber.—It was reported from most parts of the country that during the greater part of the month there was a further marked reduction in the number of small holdings in tapping. This was due mainly to exhaustion of coupons, but contributing causes were wet weather, padi harvest in some localities and the incidence of the fasting month. Towards the end of the month tapping was renewed in some areas in anticipation of the fresh issue of coupons due at the commencement of next year.

Attempts are being made in the inland Districts of Pahang to obtain for small-holders a greater difference in price between No. 1 and lower grades of rubber sheet and at the same time to demonstrate to small-holders the existence of these various grades of sheet rubber, the ultimate object being, with the assistance of the dealers, to make the sale of lower grades unprofitable. For this purpose the Rubber Supervision Licensing Boards now require that each dealer should exhibit a signboard showing the Singapore or local price, together with samples of the different grades of rubber and the difference in the price of each below that of Singapore standard sheet.

Copra.—There was a further slight rise in the price of copra during the month, but apart from this the situation showed no change from that described for the previous month.

Pineapples.—In Johore adequate fruit supplies were available and five factories continued to operate. A fairly large export to Singapore was also maintained. Prices for fresh fruit declined slightly, but remained attractive. They were for 1st quality $2.20 to $3.50, for 2nd quality $1.60 to $2.90 and for 3rd quality 70 cents to $2.50 per hundred.

In Johore, over considerable areas, pineapples interplanted in rubber continue to be uprooted as the main crop reaches maturity. On the other hand, there is considerable demand for land for the cultivation of pineapples as a sole crop.

Fruits.—In Province Wellesley there were light crops of rambutans and mangosteens sufficient only for local consumption. Durians were in season in Perak North, Selangor, Kuala Lipis District and Southern Johore. Mangosteens were also in season in Perak North, dukus in Johore North and rambutan, rambai, mata kuching, langsat, mango and quini in the inland parts of Pahang.

Interest in fruit planting appears to be well maintained in Pahang. It is reported that some 32 acres of fruit trees have been planted during the year in Kuantan District and that planting material of chikus, citrus and rambutan has been imported into the Pahang East Circle from Trengganu.

Agricultural Stations and Padi Test Stations.

Transplanting was completed on the Sungei Manik Padi Station, where recently constructed bunds have greatly improved water control. Transplanting was also completed on the Sungei Blat Test Station in Pahang and the Lumapas Plot in Brunei, while much of this work was also done on the padi area at the Agricultural Station in Labuan.

Harvesting of early maturing strains commenced on the Telok Chengai Station in Kedah. Heavy showers and winds caused some lodging of the strains Nachin 10, Siam 29 and Reyong 20 at this Station, but the water was quickly drained off so that little, if any, loss of grain is anticipated.

Harvest was in progress on the Kuang and Kajang Test Plots in Selangor, the Jelebu Plot in Negri Sembilan, the Temerloh, Pekan and Bawang Plots in Pahang and the Jemintah Plot in Johore. On the Kuang Plot considerable damage was done to the crop by the Padi Fly (*Leptocorisa* spp.), rats and birds, and at Jemintah heavy rains caused lodging of the weaker-strawed strains.

Agricultural Instruction.

Final judging in the padi sawah competition in the Seremban District of of Negri Sembilan was completed. The results were not as good as was previously anticipated, owing in the main to the fact that very little, if any, attention was given to most padi fields during the recent fasting month. Despite this somewhat disappointing result some entrants maintained their keenness throughout the competition, especially in the mukims of Rasah and Labu.

A demonstration, similar to that described in this article for last month, was given to headmen from the Selinsing, Briah and Gunong Semanggol mukims of Krian at the Government Rice Mill, Bagan Serai, on the 16th December.

The State Agricultural Officer, Johore, assisted by members of his staff gave a second demonstration to headmen and padi growers at the Jemintah Padi Test Plot on the 15th December. Some 70 people attended, and support was lent to the demonstration by the presence of the State Commissioner and the Collector and Assistant Collector of Land Revenue, Segamat. The later-maturing strains of padi were examined, and the use of the sickle for reaping, the barrel for threshing and the winnowing machine were demonstrated.

DEPARTMENTAL NOTES.

Tours of the Adviser on Agriculture.

The Adviser on Agriculture toured the Districts of Kuala Kangsar, Larut, Upper Perak, Krian, the Dindings, and the sub-Districts of Selama and Parit between 2nd and 9th December. During his tour he conferred with the Hon'ble the British Resident, Perak, with District and other administrative officers, and with Agricultural Officers on matters concerning agriculture within the State of Perak.

Visits were paid to all Agricultural Stations, the Government Rice Mill, Bagan Serai, and to a number of Padi Test Stations and school gardens.

On 15th and 16th December, the Adviser visited Singapore for the purpose of inspecting pineapple factories. On 16th he presided at a joint meeting of the Pineapple Advisory Committees for Singapore, Johore and Selangor.

Leave.

Mr. J. A. Craig, Agricultural Officer, has been granted 5 months and 12 days leave from 20th December 1935 to 31st May, 1936.

Mr. J. A. Baker, Agricultural Officer, has been granted 8 months leave, from 8th January to 7th September, 1936.

Mr. C. L. Newman, Agricultural Officer, returned from leave on 20th December, 1935, and assumed duty in the post of Agricultural Officer, Singapore.

Mr. F. Birkinshaw, State Agricultural Officer, Perak, returned from leave on 2nd January 1936.

Mr. E. A. Curtler, Agricultural Officer, Cameron Highlands, returned from leave on 19th December, 1935.

Statistical.

MARKET PRICES.

December, 1935.

Rubber.—The market remained stable during the month, with a slight improvement at the close. Spot loose opened in Singapore at 21¾ cents per lb., rising after the Christmas holidays to close at 22¼ cents. The average price for the month for No. I X. Rubber Smoked Sheet was 21.74 cents per lb. as compared with 21.88 cents in November. The average price in London was 6.33 pence per lb. and in New York 13.05 cents gold as compared with 6.31 pence and 13.08 cents gold in November.

No purchases of small-holders' rubber were made after the beginning of the month, and the following are the only prices reported:— Unsmoked sheet, price per picul; Kuala Pilah, Negri Sembilan, 5th December, $25; Kuala Kangsar, Perak, 4th December, $25; Batu Pahat, Johore, $24.

Palm Oil.—Prices quoted during December for the Malayan commodities are given in the following table.

Table I.

Prices of Palm Oil and Palm Kernels.

Date 1935.	Palm Oil in Bulk, c.i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
Dec. 6	21. 0. 0	10. 2. 6
,, 13	21. 0. 0	10. 2. 6
,, 20	20. 10. 0	10. 5. 0

Copra.—After a slight weakening at the beginning of the month, the market advanced steadily, and prices improved considerably. The sun-dried grade opened in Singapore at $5.30 per picul, and closed at $5.80, the monthly average price being $5.46, as compared with $5.22 in November. The mixed quality improved similarly, averaging $4.89 per picul as compared with $4.67 in the previous month.

Copra cake fell still further, the price remaining at $1.40 per picul throughout the month as compared with an average of $1.55 in November.

Rice.—The average wholesale prices of rice per picul in Singapore for November were as follows:— Siam No. 2 (ordinary) $3.89, Rangoon No. 1 $3.74, Saigon No. 1 $3.55, as compared with October corresponding prices

of $4.37, $3.86 and $3.82. The corresponding prices in November 1934 were $2.96, $2.95 and $2.92.

The average retail market prices in cents per gantang of No. 2 Siam rice in November were:— Singapore 31, Penang 31, Malacca 27, as compared with 32, 32 and 29 respectively in October.

The average declared trade value of imports of rice in November was $3.66 per picul, as compared with $3.80 in October and $3.59 in September.

Padi.—Retail prices per gantang ranged between 7 and 14 cents.

Tea.—During December five consignments of Malayan tea were sold on the London market; one consignment of highland tea averaged 1s. 0½d. per lb., while the remaining consignments of lowland tea were sold at prices averaging 11½d. and 1s. 0d. per lb.

Average London prices per lb. during the month for tea consignments from other countries were as follows:— Ceylon 1s. 1.47d., Java 1s. 0.55d., Indian Northern 1s. 0.56d., Indian Southern 1s. 0.37d., Sumatra 10.14d.

The latest Colombo average prices available are quoted from the *Weekly Tea Market Report*, 31st December, 1935, of the Colombo Brokers' Association, and are as follows (rupee cents per lb.):— High Grown Teas 73 cents, Medium Grown Teas 64 cents, Low Grown Teas 61 cents.

Tuba Root (*Derris*).—The Singapore market continued dull during the month. Roots sold on rotenone content remained unchanged at $48 per picul, while roots sold on a basis of ether extract declined to $30 per picul from $32.50 in November.

Coffee.—Prices in Singapore weakened during December, Sourabaya coffee falling from $13 to $14 per picul to $12 to $13 at the close. Palembang coffee averaged $7.25 per picul as compared with $7.50 in November.

Locally grown coffee ranged in price from $10 to $30 per picul in various parts of the country.

Arecanuts.—Average prices per picul in Singapore were:— Splits $5.25 to $6.68, Sliced $6.88 to $8.44, Red Whole $4.50 to $6.63, shewing little change in comparison with November.

The Singapore Chamber of Commerce average prices per picul were:— Best $6.40, Medium $5.94, Mixed $5.21.

Gambier.—The price of Block weakened slightly in the second half of December, but the monthly average was $6.75 per picul as compared with $6.60 in November. No. 1 Cube remained at $10 per picul throughout the month; the previous month's average price was $10.10.

Pineapples.—The prices per case fixed by the Packers' Combine were reduced still further to: Cubes $3.55, Sliced Flat $3.35, Sliced Tall $3.50. The November average prices were: $3.99, $3.61 and $3.78.

In Singapore fresh fruit prices per 100 were:— large $3.30 and small $2.50. Prices in Johore were:— 1st quality $3 to $4, 2nd quality $2 to $3, 3rd quality $1 to $2.

Tapioca.—Prices in Singapore weakened further at the close of the month. Average prices per picul were: Flake Fair $5.69, Seed Pearl $5.69, Medium Pearl $6.50, as compared with $5.90, $5.90 and $6.80 in November.

Sago.—Pearl, Small Fair, remained unchanged at the November closing price of $3.75 per picul, as compared with that month's average of $3.95. Flour, Sarawak Fair, fell further, averaging $2.59 per picul as compared with $2.83 in November.

Mace.—Siouw fell to $100 per picul, at which level it remained throughout the month, as compared with an average price of $117 per picul in November. Amboina rose to $70 per picul as compared with $65 in the previous month.

Nutmegs.—There was a slight improvement in the Singapore market at the close of December but average prices for the month were lower than those of the previous month. They were (per picul) 110's $34.50, 80's $35.50, as compared with $36 and $37 in November.

Pepper.—Nominal Singapore prices per picul were: Singapore Black $9, Singapore White $16.50, Muntok White $17.00.

Cloves.—Nominal prices in Singapore during December for both Zanzibar and Amboina were $37.00 per picul.

Cardamoms.—Green cardamoms were quoted during December in the Ceylon Chamber of Commerce weekly reports at 98 rupee cents to R. 1.15 per lb. falling at the close to 95 rupee cents to R. 1.05.

Tobacco.—Prices per picul were as follows:— 1st quality, $28 to $35, 2nd quality $24 to $28, 3rd quality $11 to $20. In Kuala Lipis the range was $64, $40 and $20, and in Port Dickson, Negri Sembilan, abnormally high prices were recorded, the range being $80 to $85, $70 to $75, $50 to $55.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackay & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross. London, S.W.1.

GENERAL RICE SUMMARY.*

November, 1935.

Malaya.—Imports of foreign rice during November were 53,373 tons; exports were 15,575 tons, net imports being 37,798 tons. The total of net imports for the period January to November, 1935, was 445,747 tons, an increase of 7.8 per cent. as compared with 413,344 tons in 1934.†

Of the November imports, 56 per cent. were consigned to Singapore, 15 per cent. to Penang, 8 per cent. to Malacca, 15 per cent. to the Federated Malay States and 6 per cent. to the Unfederated Malay States. Of the total, 68 per cent. came from Siam, 24 per cent. from Burma, 6 per cent. from French Indo-China, and 2 per cent. from other countries.

Of the exports during November, 72 per cent. were consigned to the Netherlands Indies, and 28 per cent. to other countries. The various kinds of rice exported were: Siam 12,229 tons (78.5 per cent.), Burma 2,054 tons (13.2 per cent.), French Indo-China 648 tons (4.2 per cent.), parboiled rice 542 tons (3.5 per cent.), local production 102 tons (0.6 per cent.).

India and Burma.—Foreign exports for the period January to October, 1935, totalled 1,519,000 tons, an increase of 20.9 per cent. as compared with 1,256,000 tons in 1934. Of the 1935 exports 3.9 per cent. were to the United Kingdom, 9.9 per cent. to the Continent of Europe, 25.0 per cent. to Ceylon, 31.9 per cent. to the Straits Settlements and the Far East, and 29.3 per cent. to other countries. The corresponding 1934 percentages were: 8.7, 18.8, 24.5, 19.7 and 28.3.

Burma's total exports of rice and bran (*Bangkok Times*, 21st November, 1935) from 1st January to 2nd November, 1935, aggregated 3,132,308 metric tons, as compared with 3,426,348 metric tons in 1934, a decrease of 8.6 per cent.

Siam.—Exports of rice and rice products from Bangkok during October were 142,818 tons (provisional). The cumulative total for the year is 1,260,987 tons, as compared with 1,528,997 tons in 1934.

Japan.—According to *The Trans-Pacific Journal* dated 21 November 1935, the supply and demand relations of rice for the year 1 November 1935 to 31 October 1936, on the basis of the second crop production and the stocks of rice at the end of the last year, have been estimated as follows:—

Supply:	Stocks on 31 October, 1935	...	1,394,110 tons
	1935 rice crop (second prediction)	...	8,002,805 „
	Estimated imports of Korean rice for 1935-36 rice year	...	1,262,272 „

* Abridged from the Rice Summary for November, 1935, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1934.

	Estimated imports of Formosan rice for 1935-36 rice year ...	701,262	tons
	Total ...	11,360,449	„
Demand:	Total consumption for 1935-36 rice year	9,957,924	„
	Estimated exports of rice ...	64,516	„
	Total ...	10,022,440	„
Stocks:	On 31st October, 1936, the between-season	1,338,009	„

French Indo-China.—Entries of padi into Cholon during the first eleven months of the year totalled 1,558,249 metric tons, as compared with 1,471,113 metric tons in 1934, an increase of 5.9 per cent. Exports of rice for the same period were 1,663,910 metric tons, an increase of 16.4 per cent.

Ceylon.—Imports for the first eleven months of 1935 amounted to 485,772 tons, as compared with 432,253 tons in 1934, an increase of 12.4 per cent.

Of these imports 12.8 per cent. were from British India, 67.2 per cent. from Burma, 0.8 per cent. from the Straits Settlements, and 19.2 per cent. from other countries. The corresponding percentages for 1934 were 13.8, 61.8, 1.7 and 22.7.

Europe and America.—Shipments from the East to Europe during the period 1st January to 21st November, 1935, aggregated 714,397 tons, as compared with 1,130,222 tons in 1934, a decrease of 36.8 per cent. Of these shipments 45.4 per cent. were from Burma, 3.3 per cent. from Japan, 44.3 per cent. from Saigon, 5.5 per cent. from Siam and 1.5 per cent. from Bengal. The 1934 corresponding percentages were 34.4, 4.2, 50.0, 9.5 and 1.9.

Shipments for the Levant from 1st January to 26th October, 1935, totalled 28,458 tons, an increase of 7.0 per cent. as compared with 1934.

Shipments for Cuba, West Indies and America from 1st January to 30th October 1935, amounted to 216,975 tons, as compared with 166,660 tons in 1934, an increase of 30.2 per cent.

MALAYAN AGRICULTURAL EXPORTS, NOVEMBER, 1935.

PRODUCT.	Net Exports in Tons.				
	Year 1934.	Jan-Nov. 1934	Jan-Nov. 1935	November 1934	November 1935
Arecanuts ...	27,336	25,776	19,637	1,936	935
Coconuts, fresh † ...	100,804†	89.787†	97,620†	5,499†	6,997†
Coconut oil ...	25,485	23,138	32,006	2,440	3,736
Copra ...	95,599	86,693	95,455	10,066	11,412
Gambier, all kinds ...	2,170	2,026	2,657	199	217
Oil cakes ...	11,273	10,597	9,855	820	953
Palm kernels ...	3,196	2,771	3,537	147	419
Palm oil ...	15,852	15,055	22,949	1,873	3,516
Pineapples canned ...	66,634	61,793	65,057	2,563	5,898
Rubber ¶ ...	479,371¶	426,871¶	353,175¶	39,591¶	26,444¶
Sago,—flour ...	10,403	8,559	8,490	1,928	545
„ —pearl ...	5,058	4,494	4,267	410	328
„ —raw ...	7,079*	6,326*	6,915*	800*	826*
Tapioca,—flake ...	5,761	5,592	1,800	454	175
„ —flour ...	1,842*	1,786*	605*	130*	81*
„ —pearl ...	15,770	14,345	15,690	1,099	648
Tuba root ...	481	462	519	15	50

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION (IN TONS) OF PALM OIL AND KERNELS

(As declared by Estates)

Month 1935	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S.
January, ...	1,062.3	339.3	174.0	49.6
February ...	977.4	220.9	161.7	38.5
March ...	1,104.3	334.2	172.6	48.6
April ...	1,008.2	328.0	151.2	40.4
May ...	1,077.1	461.8	158.6	63.1
June ...	1,311.0	724.1	200.9	105.5
July ...	1,901.2	729.0	255.3	109.0
August „ ...	2,331.5	777.9	345.5	120.0
September ...	2,080.0	607.4	231.3	87.7
October „ ...	1,869.8	512.8	306.5	54.4
November „ ...	1,464.3	400.5	280.1	58.4
Total ...	16,187.1	5,435.9	2,437.7	775.2
Total Jan. to Nov. 1934 ...	11,839.4	4,106.0	1,861.4	736.8
Total for year 1934 ...	12,965.0	4,510.0	2,013.0	795.0

MALAYAN RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 30TH NOVEMBER, 1935.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1934	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING (*a*)		AREA OF TAPPABLE RUBBER NEVER BEEN TAPPED		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,691	600	1.3	13,866	31.0	592	1.3	14,466	32.3
Malacca	123,793	1,851	1.5	28,826	23.3	3,461	2.8	30,677	24.8
Penang Island	2,593	Nil	Nil	394	15.2	123	4.7	394	15.2
Singapore Island	33,312	5,718	17.2	7,549	22.7	620	1.9	13,267	39.9
Total S.S. ...	204,389	8,169	4.0	50,635	24.8	4,796	2.3	58,804	28.8
FEDERATED MALAY STATES :—									
Perak	295,895	10,661	3.6	61,354	20.7	11,961	4.0	72,015	24.3
Selangor	345,100	10,822	3.1	64,106	18.6	12,477	3.6	74,928	21.7
Negri Sembilan	258,381	10,389	4.0	48,065	18.6	13,296	5.1	58,454	22.6
Pahang	75,912	10,100	13.3	22,037	29.0	12,551	16.5	32,137	42.3
Total F.M.S. ...	975,288	41,972	4.3	195,562	20.1	50,285	5.2	237,534	24.4
UNFEDERATED MALAY STATES :—									
Johore	417,633	18,282	4.4	66,047	15.8	33,965	8.1	84,329	20.2
Kedah	199,180	3,880	1.9	22,423	11.3	19,349	9.7	26,303	13.2
Kelantan	28,891	403	1.4	8,964	31.0	4,560	15.8	9,367	32.4
Trengganu (*b*)	4,643	Nil	Nil	15	0.3	5	0.1	15	0.3
Perlis (*c*)	1,206	Nil	Nil	395	32.8	25	2.1	395	32.8
Brunei	(*d*) 4,991	Nil	Nil	1,665	33.4	842	16.9	1,665	33.4
Total U.M.S. ...	656,544	22,565	3.4	99,509	15.2	58,746	8.9	122,074	18.6
TOTAL MALAYA ...	1,836,221	72,706	4.0	345,706	18.8	113,827	6.2	418,412	22.8

Notes :—(*a*) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(*b*) Registered Companies only.
(*c*) Rendered quarterly.
(*d*) Acreage of tappable rubber on 1st May, 1934.

MALAYA RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF NOVEMBER, 1935, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		Jan. to Nov. inclusive 1935		during the month		Jan. to Nov. inclusive 1935						
	Ports	Dealers	Estates of 100 acres and over	during the month	January to Nov. inclusive 1935	during the month	January to Nov. inclusive 1935	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January to Nov. inclusive 1935
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	8,932	10,300	10,604	122,174	3,282	64,644	Nil	Nil	17	Nil	10,789	3,504	*151,989 †140,039	43,209	...	7,953	10,864	8	99
Johore ...	...	1,884	3,655	3,743	45,126	1,866	34,691	Nil	12	Nil	168	2,167	3,513	27,945	50,775	...	1,657	3,823	...	...
Kedah ...	...	319	2,300	2,494	27,995	766	10,448	Nil	Nil	Nil	Nil	1,263	1,738	16,492	20,841	...	299	2,579	...	...
Perlis ...	...	34	11	12	118	15	208	Nil	Nil	Nil	Nil	Nil	44	Nil	337	...	17	11	...	...
Kelantan ...	...	488	274	298	3,644	399	5,375	Nil	Nil	Nil	Nil	183	609	1,909	6,777	...	393	274	...	...
Trengganu ...	...	55	50	251	2,920	126	1,461	Nil	Nil	Nil	Nil	Nil	377	Nil	4,381	...	55	50	...	...
Brunei	...	11	38	60	569	66	661	...	...	...	...	...	121	...	1,205	...	11	43	...	...
Total Malay States	...	11,723	16,628	17,462	202,546	6,520	117,491	Nil	12	17	168	14,402	9,906	198,335	127,525	...	10,385	17,644	8	99
S. SETTLEMENTS :-																				
Malacca ...	...	2,330	1,021	1,016	13,540	505	7,065	Nil		Nil		2,272		28,857		...	2,378	1,145	...	...
Province Wellesley	...	1,931	427	439	5,173	206	2,649	Nil		Nil		6,088		81,302		...	1,989	449	...	...
Penang ...	2,869	5,968	10	15	178	72	1,147	2,240	9,655	23,887	126,406		Nil		Nil	3,173	6,069	13	...	...
Singapore ...	4,617	24,143	166	144	1,949	50	1,277	8,194		142,264		20,385		243,987		2,911	20,444	169	31	427
Labuan	...	35	Nil	Nil	Nil	15	160	84		955		Nil		Nil		...	25	Nil	...	...
Total Straits Settlements	7,486	34,407	1,624	1,614	20,840	848	12,298	10,518	9,655	167,106	126,406	28,745	Nil	354,146	Nil	6,084	30,965	1,776	31	427
TOTAL MALAYA	7,486	46,130	18,252	19,076	223,386	7,368	129,789	10,518	9,667	167,123	126,574	43,147	9,906	552,481	127,525	6,084	41,290	19,420	39	526

*Ocean shipments from Malaya of rubber directly consigned from the F.M.S. † Exports of rubber from the F.M.S.

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	7,149	19,652	5,615	4,267	1,382	177
WET RUBBER	804	792	454	136	275	122
TOTAL ...	7,953	20,444	6,069	4,403	1,657	299

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to Nov. 1935
29	30	31
Singapore ...	29,195	363,719
Penang ...	8,928	125,039
Port Swettenham.	4,823	59,862
Malacca ...	201	3,861
MALAYA ...	43,147	552,481

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to Nov. 1935
32	33	34
Malay States ...	24,308	313,609
Straits Settlements	2,629	32,468
MALAYA ...	26,937	346,077

Notes:—

1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [15] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 24 December, 1935.

METEOROLOGICAL SUMMARY, MALAYA, NOVEMBER, 1935.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of			Absolute Extremes						Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.	Mean of A and B.	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	89.0	72.3	80.7	94	70	84	74	83.5	84.3	12.06	306.3	3.05	26	23	9	7		130.85	4.36	36
Bukit Jeram, Selangor ...	86.9	72.7	79.8	90	71	81	74	82.6	85.1	12.27	311.7	2.52	22	18	2	3		176.65	5.89	49
Sitiawan, Perak ...	87.0	73.3	80.1	89	72	85	75	83.1	84.1	8.87	225.3	1.84	22	19				156.50	5.22	44
Temerloh, Pahang ...	87.1	72.7	79.9	91	71	81	75	84.2	85.5	7.86	199.7	1.75	18	15	3	2		139.90	4.66	39
Kuala Lipis, Pahang ...	87.1	71.6	79.3	90	70	80	73	82.9	83.9	10.10	256.5	1.57	23	21	1	19		152.95	5.10	43
Kuala Pahang, Pahang ...	85.3	74.1	79.7	92	71	79	76	82.7	85.0	18.81	477.8	4.96	24	21	1			147.05	4.90	41
Kallang Aerodrome, S'pore ...	85.5	75.3	80.4	89	73	83	78	81.2	81.0	9.86	250.4	2.57	23	17	5			137.45	4.58	38
Butterworth, Province Wellesley ...	86.1	73.7	79.9	89	72	82	76	83.5	84.8	12.38	314.5	2.19	26	23	1		2	167.25	5.57	47
Bayan Lepas Aerodrome, Penang ...	85.9	73.9	79.9	88	71	82	76	82.4	83.2	10.56	268.2	1.23	26	24	5	1		155.95	5.20	44
Bukit China, Malacca ...	84.6	73.9	79.3	88	72	81	76	82.1	83.2	9.84	249.9	2.39	24	18			1	168.60	5.62	47
Kluang, Johore ...	86.9	71.7	79.3	92	70	80	74	81.4	82.0	5.87	149.1	1.41	20	15	3	6	1	131.10	4.37	36
Bukit Lalang, Mersing, Johore	85.0	72.2	78.6	91	71	76	73	81.2	81.5	9.34	237.2	1.60	20	20	5			152.55	5.09	42
Alor Star, Kedah ...	86.9	73.7	80.3	91	72	83	76	84.7	85.8	7.80	198.1	1.23	22	18	5	1		155.45	5.18	43
Kota Bahru, Kelantan ...	85.0	73.6	79.3	90	72	76	75	82.5	84.2	13.95	354.3	2.14	20	15		1		136.30	4.54	38
Kuala Trengganu, Trengganu	85.0	72.9	78.9	88	71	75	75	81.0	82.9	21.49	545.9	6.63	24	18	2	1		128.05	4.27	36
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	73.0	62.3	67.7	77	61	68	64	71.5	72.1	7.53	191.3	1.13	24	21		23		130.05	4.33	36
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	71.4	58.3	64.9	76	54	67	62	69.3	69.5	14.51	368.6	1.55	25	24				101.65	3.39	29
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	70.3	59.3	64.8	74	58	66	61			15.40	391.2	1.78	25	24				104.45	3.48	29

Compiled from Returns supplied by the Meteorological Branch, Malaya